Nesting behavior of *Glaucomys volans*

within Itasca State Park

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Goal

Determine nesting habits of *G. volans* as they begin to populate a new area. Specifically, what is the composition of the nest trees in the surrounding area. I predict that G. volans will select for habitats similar to their previous range within Minnesota.

Background

The flying squirrel is a nocturnal rodent of genus *Glaucomys* found throughout North America. There are two known species of flying squirrels, the northern, *Glaucomys sabrinus* and the southern, *Glaucomys volans*. The range of *G. volans* spans from Northern Mexico to Minnesota and its habitat consists mainly of deciduous forest, while *G. sabrinus* selects for a more coniferous habitat (Hazard 1982). Within Minnesota, the northern limit of *G. volans* corresponds to the deciduous forest limit, where the forest begins to turn coniferous, near Itasca State Park in Clearwater County. In the past, Itasca State park was home to numerous G. *sabrinus* and relatively few *G. volans* (Sikes et al. 2003). However, in recent years, the *G. volans* population has become more abundant in the Itasca area, according to data collected by the University of Minnesota's Field Mammalogy class. However, because of a recent combination of climate change and the halting of controlled burns in the area, the once expansive pine forest of Itasca State Park has started to transform into a deciduous woodland, more suitable for *G. volans* (Frissell 1973). As the forest transformed, *G. volans* was able to expand its range into the territory once occupied primarily by *G. sabrinus*.

With this expansion in range into Itasca State Park *G. volans* and *G. sabrinus* overlap in territory. The two species are usually not seen living in the same location for a number of reasons. *G. volans* is a host of an intestinal parasite that is generally not harmful; however, the parasite can be transferred to *G. sabrinus* in which it is lethal (Evans et al. 2014). *G. volans* has also been observed to be more aggressive and will therefore displace *G. sabrinus* (Weigl 1978). If *G. sabrinus* is fully displaced in this area and *G. volans* continues to expand its range, there is a possibility of *G. sabrinus* becoming endangered. In North Carolina a similar event occurred. *Glaucomys volans* had overlapped in range with *G. sabrinus* and now the specific subspecies of *G. sabrinus* that lives in the Appalachian Mountains is endangered (Evans et al. 2014).

Throughout its large range, *G. volans* has been seen to choose different nest sites and behave differently depending on where it resides and what climate it is in (Weigl 1978). The objective of this study was to provide information about what occurs when *G. volans* expands its range into an area that is already occupied by *G. sabrinus*. Determining habitat preferences of *G. volans* may give insight into potential land management practices to protect *G. sabrinus* in other instances of habitat overlap.

Female *Glaucomys volans*; frequency 151.505A

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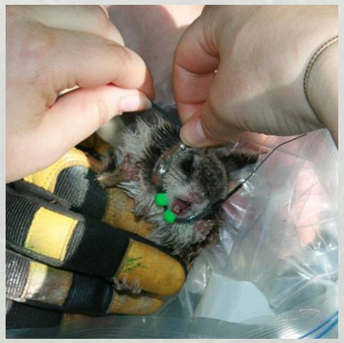
Background image: http://biologyprojectwiki.wikispaces.com/file/view/404916872_3fa7a9e7b3_o.jpg/107401113/404916872_3fa7a9e7b3_o.jpg

Methods

Trapping

We used three methods of trapping. The first method was setting Sherman live traps on the ground, the second method was strapping Tomahawk traps in trees using bungee straps, and the third was placing Sherman live traps within half the Tomahawk traps strapped to trees. We set traps in the afternoon and checked them the next morning.

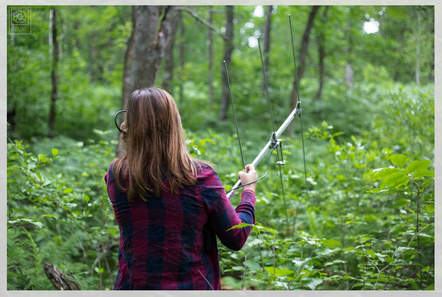


Collaring

When an individual was captured, we recorded observational characteristics and inserted a passive integrated transponder, PIT-tag, under the skin between the shoulder blades. We then collared the individual with a SOM-2038A radio-transmitting collar from Wildlife Materials. Collars were fitted with aquarium tubbing and two colored beads for identification and spacing. Two researchers worked together to collar individuals without the use of anesthetic.

Tracking

We used telemetry to track the location of *G. volans*. We tracked from the beginning of June until the end of July. Tracking was done frequently to locate nest sites, and locations were recorded via a GPS system. We did most of the tracking during daylight hours, as *G. volans* is nocturnal and would likely be residing in its nest during those hours.



Habitat Data Collection

We recorded data on habitat variables around each nest location. For each nest tree, tree height, DBH, genus, and stage of decay was recorded. An area of land was a radius of ten meters directly surrounding each nest tree was also observed. Within the plot we recorded characteristics of litter depth, duff depth, number of snags, canopy cover, groundcover, understory, and coarse woody debris.

Results

Glaucomys volans selected nest trees with a mean height of 21.65±3.24m and mean DBH of 37.85±3.15cm. Dead trees were used 35% of the time and alive trees 65%. However, all 65% (11) of alive trees were in a declining state. Snags were 29% (4), and 12% (2) were fallen, decomposing, trees (Fig 1). There were 2.25±0.4 snags per plot. All of the trees selected were deciduous (oak, maple, aspen, and birch) except for two trees that had fallen, as those were red pine. The composition of cover on the plot consisted of a proportion of 0.86±0.0016 of canopy, 0.76±0.0056 of subcanopy, and 0.95±0.001 groundcover (Fig. 2). As for soil composition throughout the plots, on average there was 3.43±0.36cm of litter and 3.49±0.28cm of humus (Fig.3). Coarse woody debris averaged to have a volume of 1.88±0.38m^3 per plot.

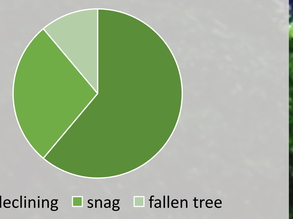


Figure 1: Proportion of nest trees at decay stages. 65% (11) were in a declining state, 29% (4) were snags, and 12% (2) were fallen decomposing trees

Figure 2: Composition of forest cover within plot. Mean±SE proportion of canopy 0.86±0.0016, subcanopy 0.76±0.0056, and groundcover 0.95±0.001.

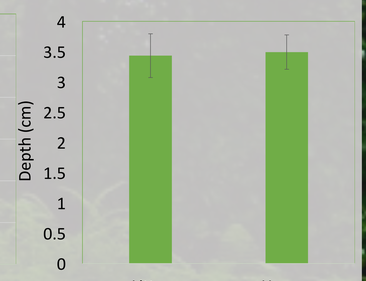


Figure 3: Composition of soil within plot. Mean±SE depth of litter 3.43±0.36cm and humus 3.49±0.28cm.

Discussion

We did not find any significant trends for habitat characteristics of nest sites used by *G. volans*. One reason for this finding may be that G. *volans* is selecting nest trees with cavities already excavated within them, following selection patterns of local woodpeckers, as *G. volans* does not excavate their own nest sites (Bendel and Gates 1987). *G. volans* did not choose any "healthy" trees as nesting sites, all nest trees were dead or declining. The snags and large declining trees may be favored by *G. volans* as they reduce predation risk and have increased insulation (Smith 2007). The use of dead trees may pose a future implication for land management practices. Snags and declining trees have been found to provide essential nesting habitats for both species of *Glaucomys,* especially in the northern ranges (Holloway and Malcolm 2007)Therefore, it is important to leave a number of declining and dead trees within forests to suppose the population of flying squirrels.

Nest 53; snag

There were some limitations present in this study. First, the sample size was only n=7, as we only had seven collars to deploy. We were also not able to track every day, so there may have been more nests used then recorded. Habitat data was also not always collected soon after the use of a nest site for all the nest sites, which may have altered data as the forest changes over time. One challenge with this study, that comes along with the study of wild animals, is that *Glaucomys* have some of the highest recorded baseline cortisol levels in mammals (Desantis et al. 2016). When we handled *G. volans,* cortisol levels are likely to have spiked with the induced stress. This stress response may have altered *G. volans* selection of nest sites. In the future, tracking would be completed daily and habitat data would be collected as soon as the nest site it abandoned. One addition to this study for future years to come, could be to collect habitat data from random trees in the same forest for comparison to nest site habitat data.